



GRADE 12  
DIPLOMA EXAMINATION  
Mathematics 30

January 1984

**Alberta**  
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**GRADE 12 DIPLOMA EXAMINATION  
MATHEMATICS 30**

**DESCRIPTION**

Time: Two and one-half hours

Total possible marks: 65

This is a **CLOSED BOOK** examination consisting of two parts:

**PART A:** 52 multiple-choice questions each with a value of 1 mark.

**PART B:** Five written-response questions for a total of 13 marks.

A mathematics data booklet is provided for your reference. Approved calculators may be used.

**GENERAL INSTRUCTIONS**

Fill in the information on the answer sheet as directed by the examiner.

For multiple-choice questions, read each carefully and decide which of the choices **BEST** completes the statement or answers the question. Locate that question on the answer sheet and fill in the space that corresponds to your choice. Use an HB pencil only.

**Example**

**Answer Sheet**

This examination is for the subject area of

A	B	C	D
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>

- A.** Chemistry
- B.** Biology
- C.** Physics
- D.** Mathematics

If you wish to change an answer, please erase your first mark completely.

For written-response questions, read each carefully and write your answer in the space provided.

**DO NOT FOLD EITHER THE ANSWER SHEET OR THE EXAMINATION BOOKLET.**

The presiding examiner will collect the answer sheet and examination booklet for transmission to Alberta Education.

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JANUARY 1984





# **PART A**

## **INSTRUCTIONS**

There are 52 multiple-choice questions with a value of one mark each in this section of the examination. Use the separate answer sheet provided and follow the specific instructions given.

**YOU SHOULD SPEND NO MORE THAN 2 HOURS ON THIS PART OF THE EXAMINATION.**

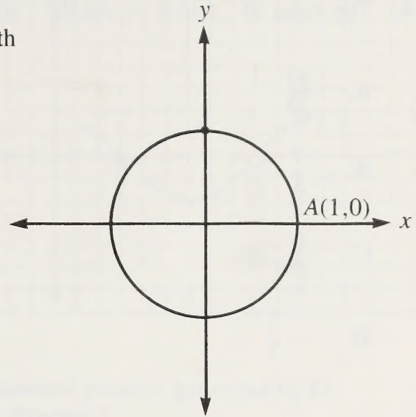
When you have completed Part A, continue directly to Part B.

**DO NOT TURN THE PAGE TO START THE EXAMINATION UNTIL TOLD TO DO SO BY THE PRESIDING EXAMINER.**

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1. In the unit circle to the right, the co-ordinates of the terminal point of the path  $\left(A, -\frac{11\pi}{3}\right)$  are

- A.  $\left(\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$   
B.  $\left(\frac{\sqrt{3}}{2}, \frac{1}{2}\right)$   
C.  $\left(\frac{1}{2}, -\frac{\sqrt{3}}{2}\right)$   
D.  $\left(\frac{\sqrt{3}}{2}, -\frac{1}{2}\right)$



2. The domain of the tangent function is

- A.  $\left\{ \frac{y}{x} \mid \frac{y}{x} \in \mathbb{R} \right\}$   
B.  $\left\{ \frac{y}{x} \mid x, y \in \mathbb{R} \right\}$   
C.  $\left\{ \theta \mid \theta \in \mathbb{R} \right\}$   
D.  $\left\{ \theta \mid \theta \in \mathbb{R}, \theta \neq \frac{\pi}{2} + n\pi, n \in \mathbb{I} \right\}$

3. If  $2 \cos A - 1 = 0$ ,  $0 \leq A < 2\pi$ , then A is equal to

- A.  $\frac{2\pi}{3}, \frac{5\pi}{3}$   
B.  $\frac{2\pi}{3}, \frac{4\pi}{3}$   
C.  $\frac{\pi}{3}, \frac{2\pi}{3}$   
D.  $\frac{\pi}{3}, \frac{5\pi}{3}$

4. The value of  $(\sin \theta - \cos \theta)^2$  when  $\cot \theta = -\frac{3}{4}$  and  $\sin \theta$  is negative is

A.  $\frac{49}{25}$

B.  $\frac{7}{5}$

C.  $\frac{6}{25}$

D.  $-\frac{7}{5}$

5. If  $\sin \theta = \frac{a}{b}$  and  $\tan \theta = \frac{a}{2}$ , then  $\cos \theta$  is

A.  $\frac{b}{a}$

B.  $\frac{b}{2}$

C.  $\frac{2}{b}$

D.  $\frac{2}{a}$

6. The exact value of  $\sin 75^\circ$  is

A.  $\frac{\sqrt{2} + \sqrt{6}}{2}$

B.  $\frac{\sqrt{2} + \sqrt{6}}{4}$

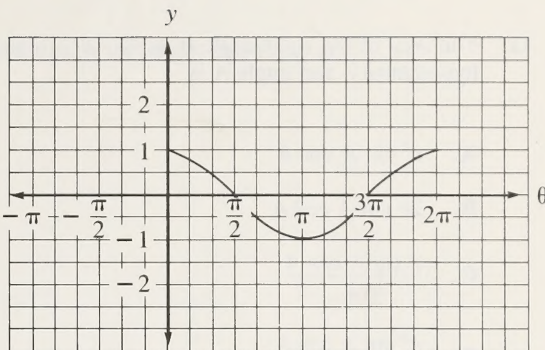
C.  $\frac{\sqrt{6} - \sqrt{2}}{2}$

D.  $\frac{\sqrt{6} - \sqrt{2}}{4}$



7. The graph shown represents the function

- A.  $y = \csc \theta, 0 \leq \theta \leq 2\pi$   
 B.  $y = \sec \theta, 0 \leq \theta \leq 2\pi$   
 C.  $y = \cos \theta, 0 \leq \theta \leq 2\pi$   
 D.  $y = \sin \theta, 0 \leq \theta \leq 2\pi$



8. What is the radian measure of an angle in standard position generated by  $2\frac{1}{2}$  rotations of the terminal arm in the positive direction?

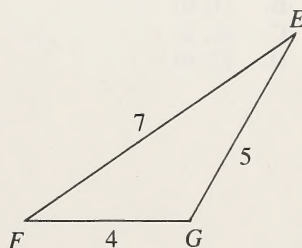
- A.  $2\pi$   
 B.  $5\pi$   
 C.  $\frac{5\pi}{2}$   
 D.  $\frac{2\pi}{5}$

9. The value of  $\sin 192^\circ$  is equal to the value of

- A.  $-\sin 78^\circ$   
 B.  $\sin 78^\circ$   
 C.  $-\sin 12^\circ$   
 D.  $\sin 12^\circ$

10. In the diagram to the right, the measure of  $\angle F$  to the nearest degree is

- A.  $44^\circ$   
 B.  $46^\circ$   
 C.  $48^\circ$   
 D.  $52^\circ$



11. The area of the right angle triangle  $ABC$  in terms of hypotenuse  $c$  and angle  $A$  is

A.  $c^2 \sin A \cos A$

B.  $2c \sin A \cos A$

C.  $\frac{c \sin A \cos A}{2}$

D.  $\frac{c^2 \sin A \cos A}{2}$

12. The centre of the circle  $x^2 + y^2 - 6x + 10y - 16 = 0$  is at

A.  $(6, -10)$

B.  $(-6, 10)$

C.  $(-3, 5)$

D.  $(3, -5)$

13. The equation of a circle having a line segment from  $A(3, 9)$  to  $B(1, -1)$  as a diameter is

A.  $(x - 1)^2 + (y - 5)^2 = 36$

B.  $(x - 2)^2 + (y - 4)^2 = 104$

C.  $(x - 2)^2 + (y - 4)^2 = 26$

D.  $(x - 1)^2 + (y - 5)^2 = 104$

14. The focus of the parabola  $2x^2 = 8y$  is at

A.  $(0, 1)$

B.  $(1, 0)$

C.  $(0, 2)$

D.  $(2, 0)$

15. The equation of a parabola with vertex at the origin and focus at  $(m, 0)$  is
- A.  $x^2 = 4my$
  - B.  $x = m^2y$
  - C.  $y = m^2x$
  - D.  $y^2 = 4mx$
16. The cable of a suspension bridge hangs in the shape of a parabola. Two supporting towers of equal height are located 100 m apart. If  $x^2 = 500y$  is the equation used to describe the shape of the suspended cable, how high above the lowest point on the cable is it attached to the supporting tower?
- A. 1 m
  - B. 5 m
  - C. 2 m
  - D. 4 m
17. The length of the major axis of the ellipse  $\frac{x^2}{3} + y^2 = 1$  is
- A.  $\sqrt{3}$
  - B.  $2\sqrt{3}$
  - C. 2
  - D. 6

18. An ellipse with foci  $(0, \pm 4)$  and vertices  $(0, \pm 9)$  is

A.  $\frac{x^2}{65} + \frac{y^2}{81} = 1$

B.  $\frac{x^2}{16} + \frac{y^2}{81} = 1$

C.  $\frac{x^2}{81} + \frac{y^2}{16} = 1$

D.  $\frac{x^2}{81} + \frac{y^2}{65} = 1$

19. The graphs with the defining equations  $x^2 + y^2 = 1$ ,  $x^2 + 4y^2 = 1$ ,  
 $x^2 - \frac{y^2}{4} = 1$ , and  $x^2 - 1 = y$  have

- A. symmetry with respect to the origin
- B. the same shape
- C. the same y-intercepts
- D. the same x-intercepts

20. The asymptotes of the hyperbola  $\frac{x^2}{25} - \frac{y^2}{36} = 1$  are

A.  $y = \pm \frac{36}{25} x$

B.  $y = \pm \frac{25}{36} x$

C.  $y = \pm \frac{6}{5} x$

D.  $y = \pm \frac{5}{6} x$



21. Given  $9x^2 - 16y^2 = 144$ , the distance between the two foci is
- A. 5
  - B. 6
  - C. 8
  - D. 10
22. The equation defining the hyperbola passing through  $M(2, 0)$  with centre at the origin, transverse axis along the  $x$ -axis, and conjugate axis of length 6 units, is
- A.  $9x^2 - 4y^2 = 36$
  - B.  $9y^2 - 4x^2 = 36$
  - C.  $4x^2 - 9y^2 = 36$
  - D.  $4y^2 - 9x^2 = 36$
23. Of the following, the finite sequence is
- A.  $2 + 4 + 6 + 8 + 10 + 12 + 14$
  - B.  $3, 9, 27, 81, \dots, 3^n, \dots$
  - C.  $5, 10, 15, 20, \dots, 85$
  - D.  $1 + 3 + 5 + \dots + (2n - 1) + \dots$
24. Assuming that the sequence  $2, 5, 8, \dots$  is arithmetic or geometric, the 70th term is
- A. 207
  - B. 209
  - C. 212
  - D. 215

25. In a potato race, 20 potatoes are placed 1 m apart in a straight line, the first being placed 5 m from the starting point. To complete the race, a contestant must collect and return the potatoes one at a time to the starting point. The total distance travelled by a contestant successfully completing the race is

A. 290 m  
B. 300 m  
C. 580 m  
D. 1160 m

26. The number of terms in the geometric sequence  $2, 4, \dots, 512$  is

A. 10  
B. 9  
C. 8  
D. 7

27.  $\sum_{k=5}^{18} (2k - 3)$  is equal to

A. 360  
B. 312  
C. 280  
D. 260

28.  $\lim_{x \rightarrow \infty} \left( \frac{5x^2 + 2x^2 - 7}{3x^2 - 2x + 6} \right)$  is

A.  $-\frac{6}{7}$   
B.  $-1$   
C.  $\frac{6}{5}$   
D.  $\frac{5}{3}$

29. The limit of the sequence  $-4, 4, -4, 4, \dots 4(-1)^n \dots$  is
- non-existent
  - 0
  - 4
  - 4
30. If the sum of an infinite geometric series is 3 and the common ratio is  $\frac{1}{3}$ , then the first term is
- $\frac{9}{2}$
  - 2
  - 1
  - 0
31. A ball dropped from a height of 50 m rebounds on each bounce to a distance  $\frac{9}{10}$  of the height from which it fell. The total distance the ball travels in coming to rest is
- 1000 m
  - 950 m
  - 900 m
  - 500 m
32. The range of the data at the right is
- |    |    |    |    |    |
|----|----|----|----|----|
| 17 | 19 | 24 | 27 | 13 |
| 16 | 23 | 27 | 25 | 27 |
| 13 | 27 | 28 | 26 | 24 |
| 14 | 27 | 21 | 23 | 19 |
- 12
  - 28
  - 15
  - 27

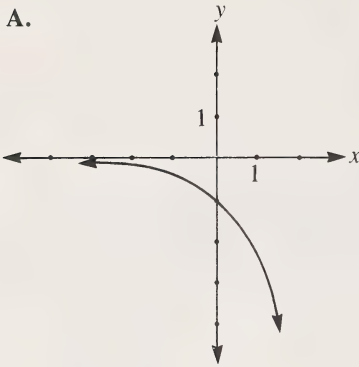
33. In a normal distribution, the data are distributed so that 95% of the data are within how many standard deviations of the mean?
- A. 1
  - B. 2
  - C. 3
  - D. 4
34. A cafe serves its customers in a mean time of 10 min and the standard deviation is 2 min. Assuming normal distribution, if a cafe serves 100 customers, the expected number served within 12 min is
- A. 90
  - B. 84
  - C. 80
  - D. 68
35. From previous observations, police know that the speeds of cars in a 60 km/h zone are normally distributed about a mean of 63 km/h with a standard deviation of 3 km/h. A radar speed trap is set up in a 60 km/h zone and the speeds of 150 cars are monitored. If the police must allow 10% of the posted limit as a margin for error, the expected number of cars stopped for speeding is
- A. 126
  - B. 99
  - C. 51
  - D. 24
36. On a university entrance exam, the mean of all the scores was 53 and the standard deviation was 5.2. If Sue's score on the test was 65, what was her z-score?
- A. 2.3
  - B. 10.2
  - C. 12.0
  - D. 12.5



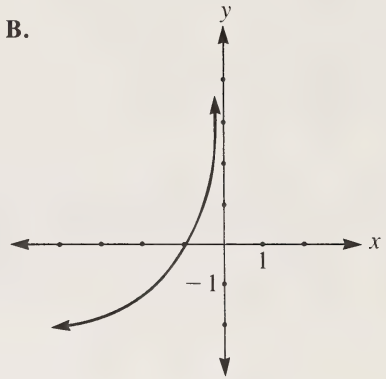
37. A brush manufacturer determines the mean life of his brushes to be five years, with a standard deviation of two years. If he guarantees his brushes for three years, the percentage of brushes that he will have to replace is
- A. 60
  - B. 33
  - C. 20
  - D. 16
38. The heights of 1500 students at a local high school were determined and the results analyzed. If the heights were normally distributed about a mean of 165 cm and a standard deviation of 12 cm, the number of students who are taller than 180 cm is
- A. 1341
  - B. 1200
  - C. 592
  - D. 158
39. The “life” of lawnmower engines is normally distributed with a standard deviation of 27 months. The manufacturer guarantees the engines for five years. If the probability that a lawnmower is returned under this guarantee is 0.06, then the mean life of the engine is
- A. 102 months
  - B. 72 months
  - C. 64 months
  - D. 56 months

40. The diagram that best illustrates the graph of  $y = 2^x$  is

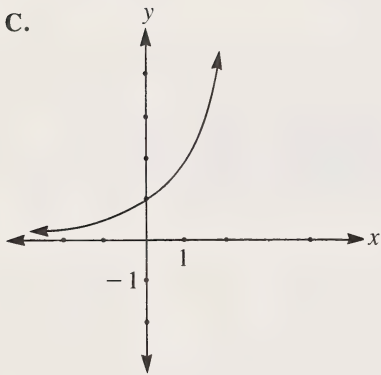
A.



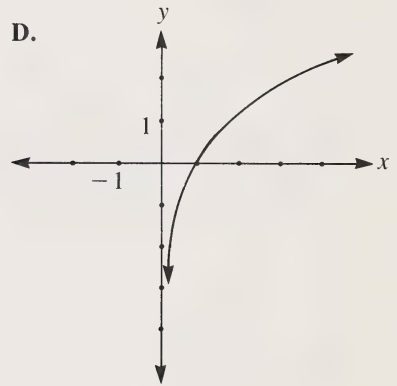
B.



C.



D.



41. If  $\log_a\left(\frac{1}{8}\right) = 3$ , then the value of  $a$  must be

A.  $\sqrt[8]{3}$

B.  $\frac{1}{2}$

C. 24

D.  $3\frac{1}{8}$

42. The value of  $x$  in the equation  $x^{3.5} = 2$  is approximately equal to

- A. 11.3
- B. 7.0
- C. 1.2
- D. 1.8

43. Solve for  $x$ :  $8^{3x-1} = 16^{x+8}$

- A. 7
- B. 2
- C.  $\frac{35}{13}$
- D.  $\frac{29}{13}$

44. Which of the following is equal to  $\log_3(27mn)$ ?

- A.  $3 \log_3(mn)$
- B.  $9 \log_3(mn)$
- C.  $3 (\log_3 m) (\log_3 n)$
- D.  $3 + \log_3(m) + \log_3(n)$

45. The time it takes for an investment to increase its value to a specified amount is given by

$$\text{time} = \frac{6}{\log(3)} \times \log\left(\frac{\text{final amount}}{\text{initial investment}}\right)$$

How many years will it take for a \$700 investment to increase to \$700 000?

- A. 25.2 years
- B. 37.7 years
- C. 17.2 years
- D. 8.6 years

46. The quotient, when  $6x^3 + x^2 - 7x - 3$  is divided by  $2x + 1$ , is
- A.  $3x^2 - x + 3$
  - B.  $3x^2 - x - 3$
  - C.  $3x^2 + x - 3$
  - D.  $3x^2 + x + 3$
47. If  $x^4 - 5x^3 + 2x^2 - x - 1$  is divided by  $x - 2$ , then the remainder is
- A.  $-19$
  - B.  $-15$
  - C.  $17$
  - D.  $65$
48. If the remainder is 5 when  $x^3 - 7x - m$  is divided by  $x + 1$ , then  $m$  is
- A.  $-13$
  - B.  $-1$
  - C.  $1$
  - D.  $13$
49. If  $(x + 5)$  is a factor of  $P(x)$ , then
- A.  $x = 5$
  - B.  $P(-5) = 0$
  - C.  $P(5) = 0$
  - D.  $P(x) = 0$
50. If  $P(2) = 0$ , then a complete factorization of  $P(x) = 6x^3 - 5x^2 - 17x + 6$  is
- A.  $(x - 2)(3x - 1)(2x + 3)$
  - B.  $(x - 2)(3x + 1)(2x - 3)$
  - C.  $(x + 2)(3x - 1)(2x + 3)$
  - D.  $(x + 2)(3x + 1)(2x - 3)$



51. One potential  $x$ -intercept for the graph of  $P(x) = 2x^5 - 7x^3 + 3x + 9$  is

A. 18

B.  $\frac{9}{2}$

C. 2

D.  $\frac{1}{9}$

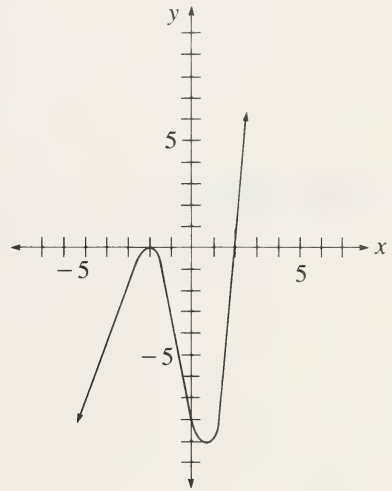
52. The graph to the right is the graph of one of the functions below. The function is

A.  $y = x^3 + 2x^2 - 4x - 8$

B.  $y = x^3 - 2x^2 - 4x + 8$

C.  $y = x^3 - 4x$

D.  $y = -x^3 + 4x$



# **PART B**

## **INSTRUCTIONS**

**ONE MARK ONLY FOR EACH CORRECT ANSWER**

**OTHER MARKS WILL BE GIVEN FOR CORRECT METHOD AND/OR  
APPROPRIATE DIAGRAM**

The VALUE assigned to each question is indicated to the left of the space provided to answer the question. Place your final answer in the space provided. Show calculations and units used.

**TOTAL MARKS: 13**

**START PART B IMMEDIATELY.**

1. The angle of elevation to the top of a building is  $30^\circ$ . When you move 20 m closer to the building, the angle of elevation becomes  $45^\circ$ . How tall is the building? (Answer to the nearest metre if not exact.)

(3 marks)

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2. A scoreboard is at one focus of an elliptical racetrack. The farthest point of the track from the scoreboard is 1008 m and the closest point is 400 m. If the racetrack is of the form  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ , determine the numerical value of  $a$  and  $b$ .

(2 marks)

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3. George deposits a certain amount of money each half year in a fund which bears interest at 8% compounded semi-annually. What sum must be deposited so that, immediately after the 4th deposit has been made, \$470 will be available? (Answer to the nearest cent.)

(3 marks)

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4. If  $\log_{(m+n)} 81 = 4$  and  $\log_{(m-n)} 64 = 6$ , find the values for  $m$  and  $n$ .

(3 marks)

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5. Find the  $x$ -intercepts for the graph of  $y = x^3 - 2x^2 - x + 2$ .

(2 marks)

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CITY: \_\_\_\_\_

**SIGNATURE:** \_\_\_\_\_